Staying Alive: robust electrical and communications design

for remote monitoring stations in high-elevation environments

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NSF

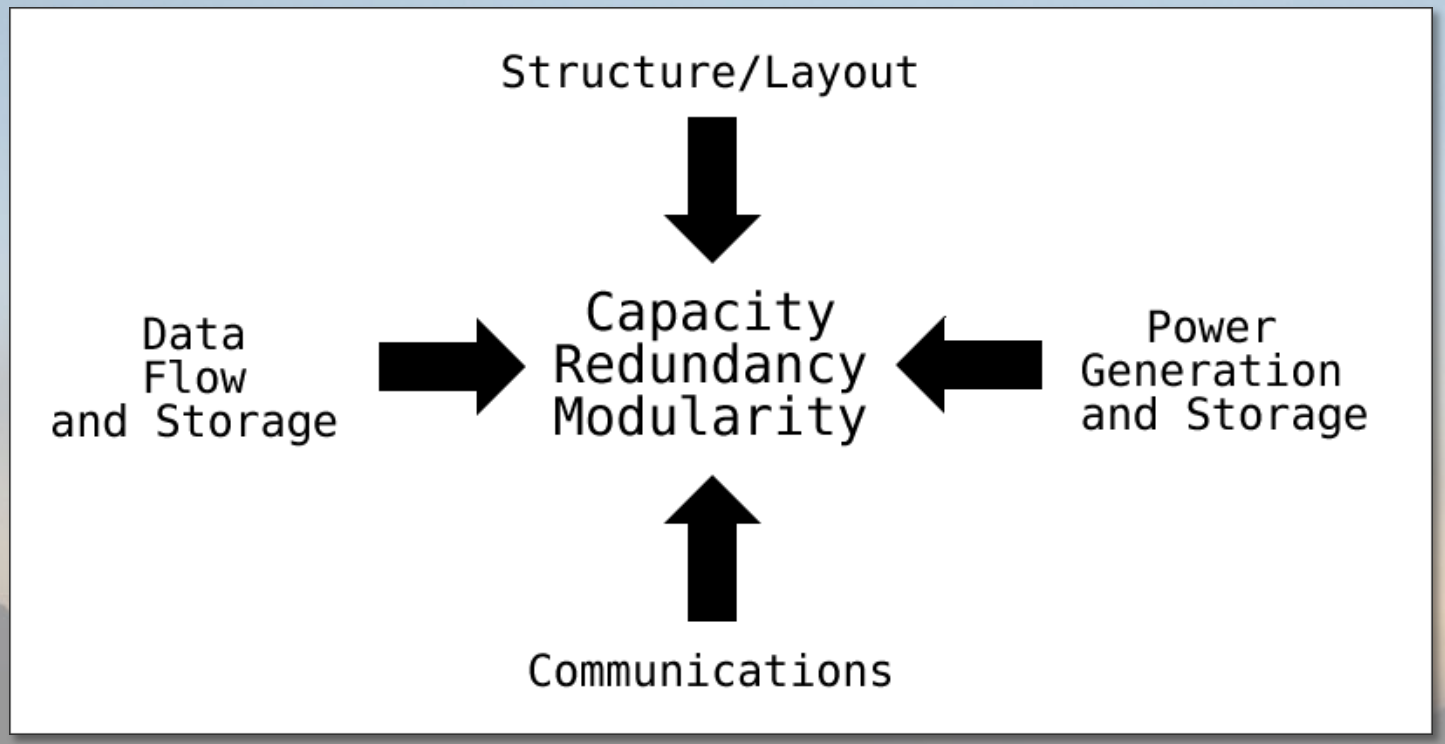
DRI Desert Research Institute

EPSCoR NEVADA

University of Nevada, Reno
The Mackay School of Earth Sciences and Engineering

NEVADA SEISMOLOGICAL LABORATORY

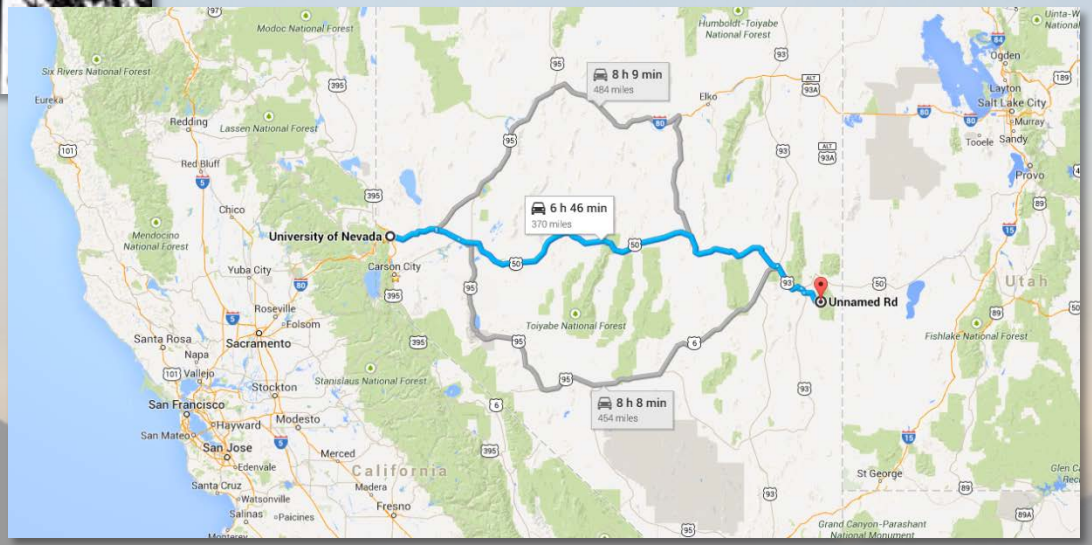
As technology enables massive collection of field sensor data, deployments must be designed to minimize field maintenance time.



Why think about remote station reliability?

- *Extreme environments*
- *Long term deployment*

- *Distance/expense*
- *Sustainability*



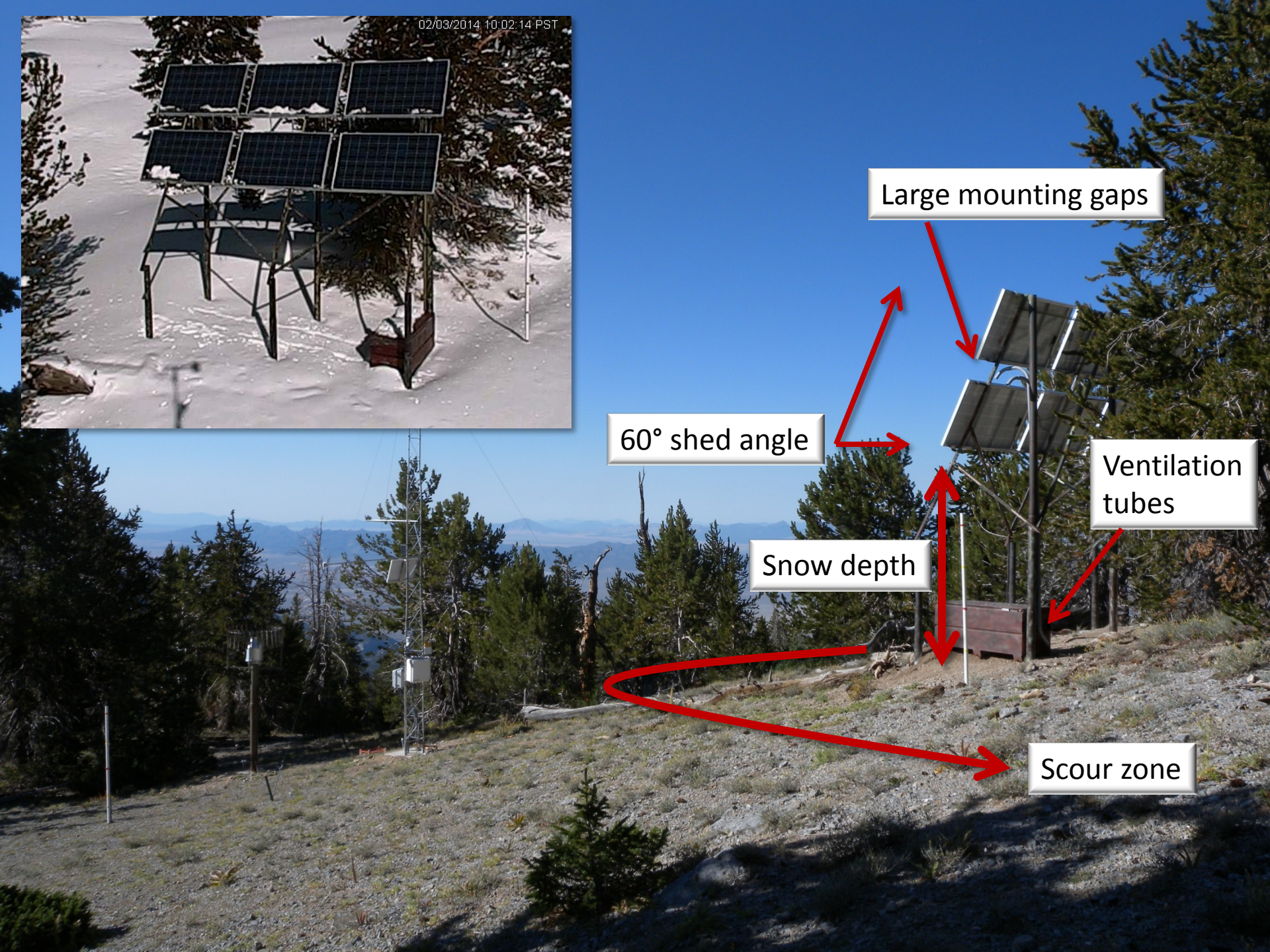
Scale: small unattended observation stations

Challenge: Electrical Power

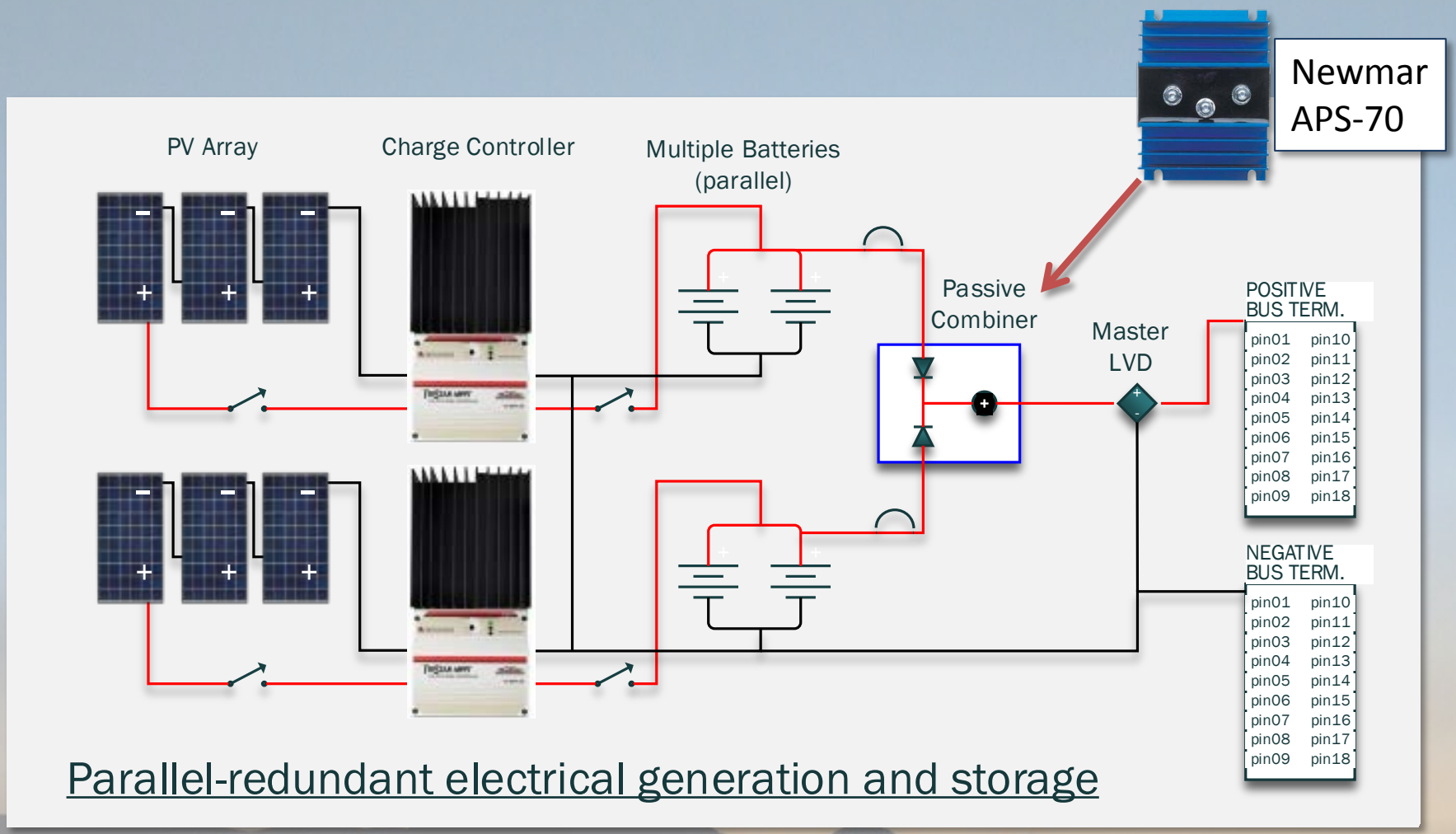
Sources: grid, **SOLAR**, mechanical/wind, fuel

- *Icing*
- *Wind loading*
- *Shading*
- *Low temperatures*

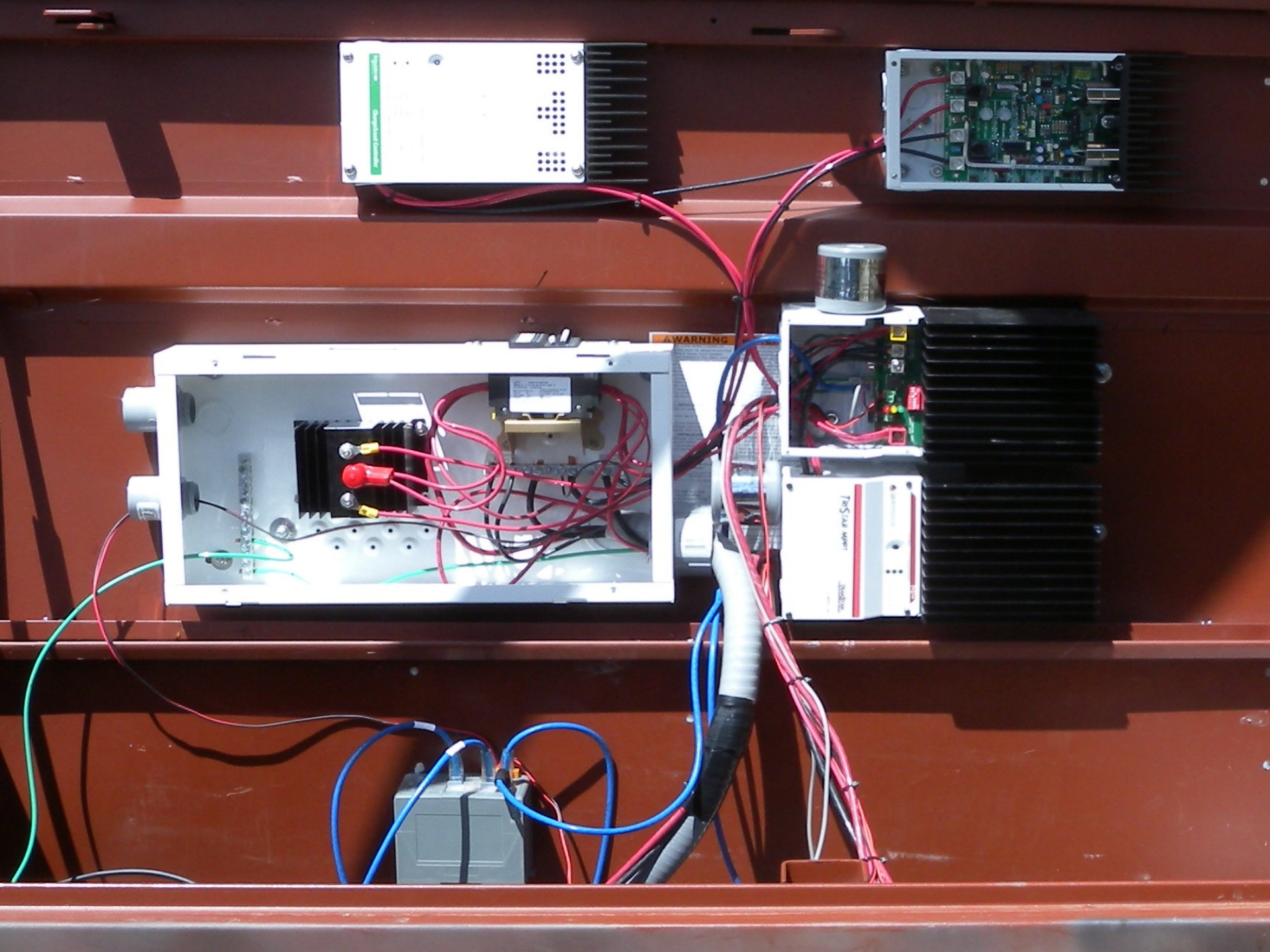
How can we maximize capacity and reduce downtime?


02/03/2014 10:02:14 PST
Large mounting gaps
60° shed angle
Ventilation tubes
Snow depth
Scour zone

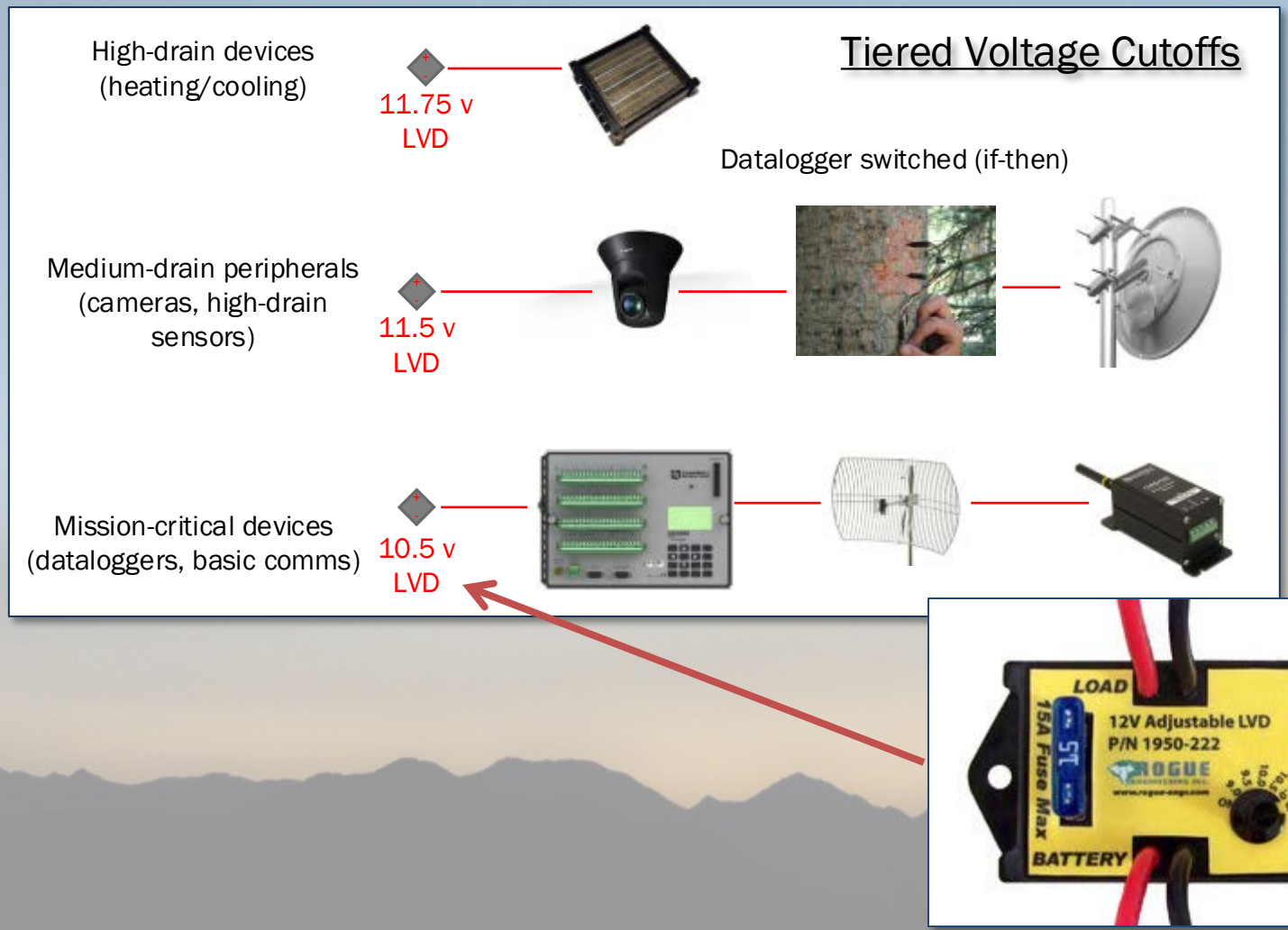
Electrical Power Redundancy

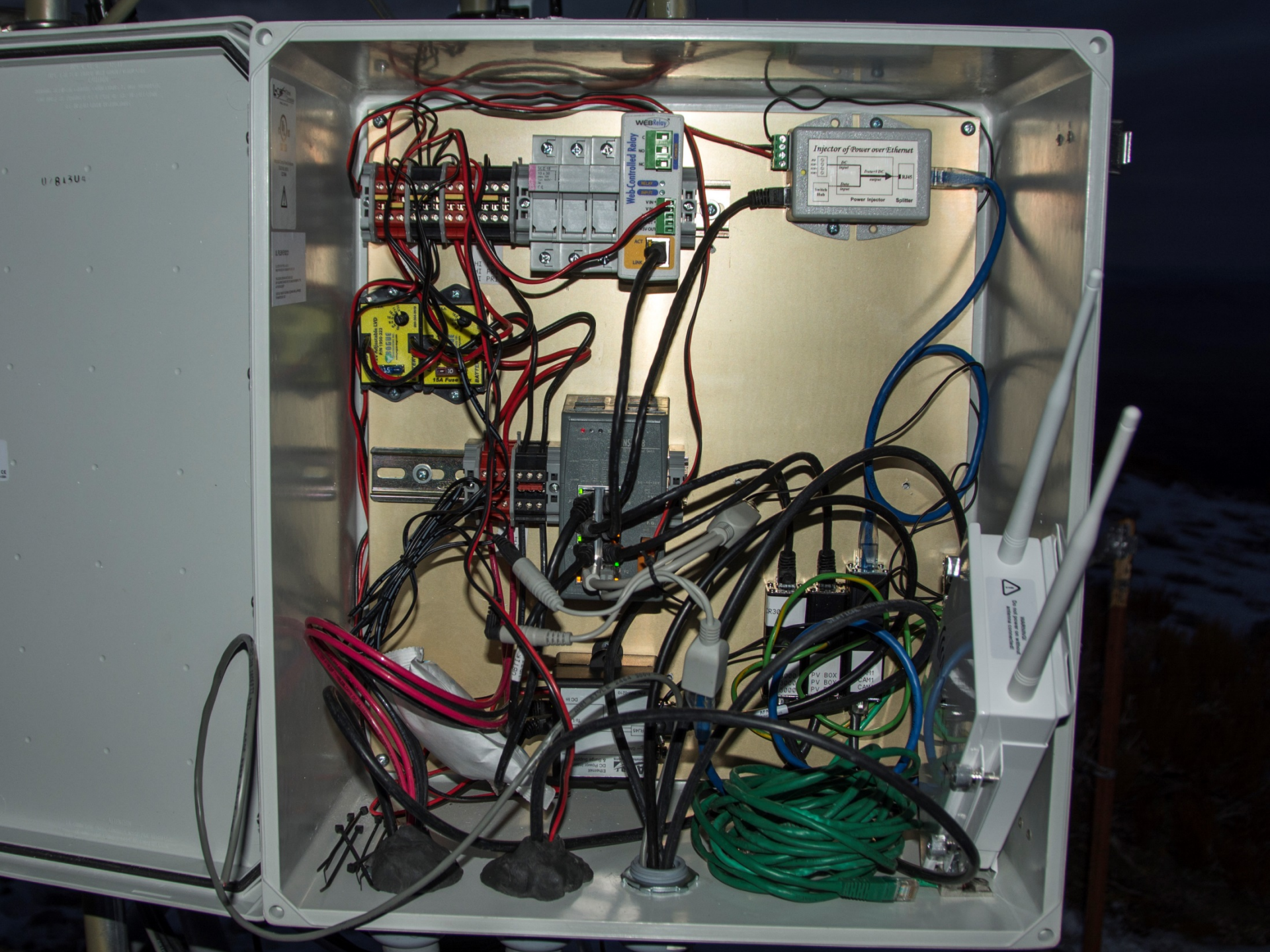


Parallel-redundant electrical generation and storage


WARNING

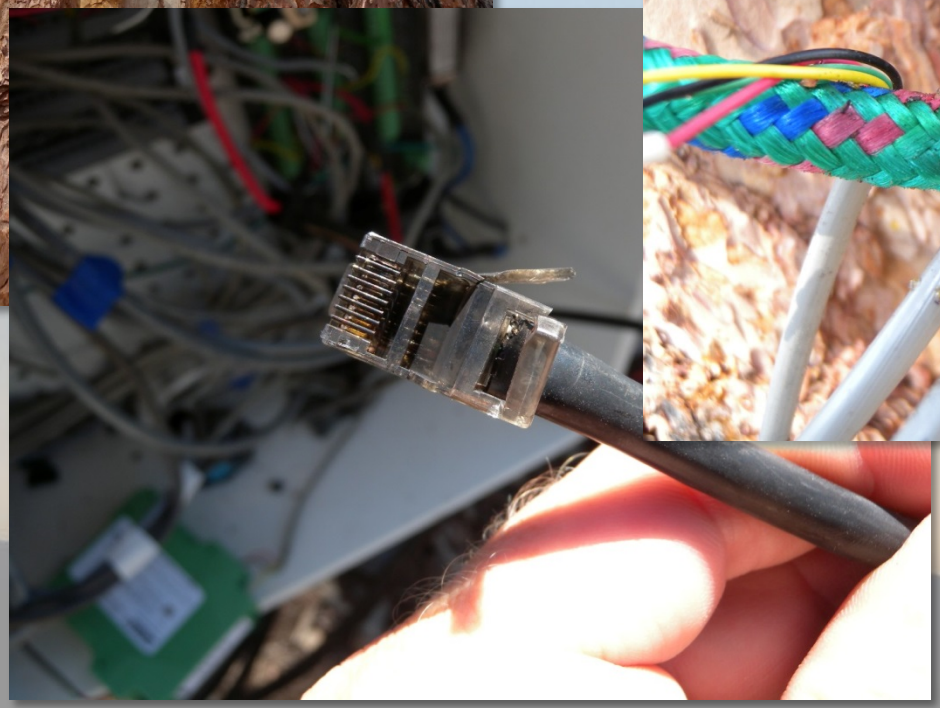
Electrical Power Protection:
Low-voltage disconnects




WEBRelay
Web-Controlled Relay
Injector of Power over Ethernet
Power Injector
Splitter
15A Fuse

Potential Problems

- *Lightning*
- *Sensor/component failure*



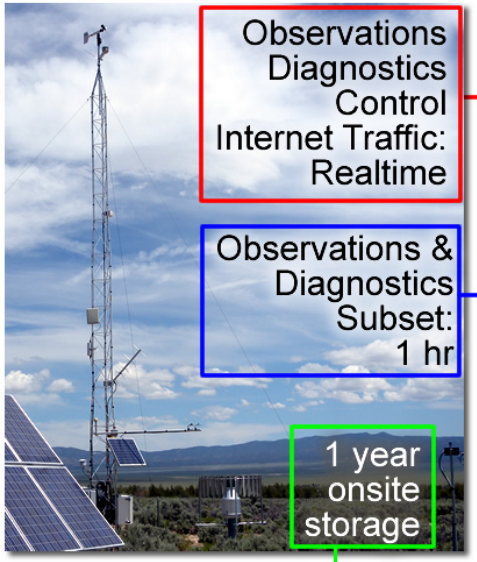
Challenge: Data Communications

Enables: data transfer, remote control, remote troubleshooting, advanced systems

- *Speed/protocol*
- *Power requirements*
- *Hardware expense*
- *Infrastructure*
- *Expertise*

How can we reduce downtime and maximize capacity?

Data Flow, NevCAN stations



Field Wireless Network

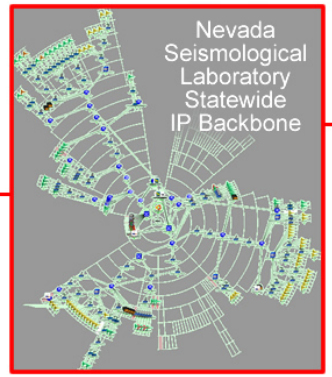
NOAA/GOES Satellite

Seasonal Download

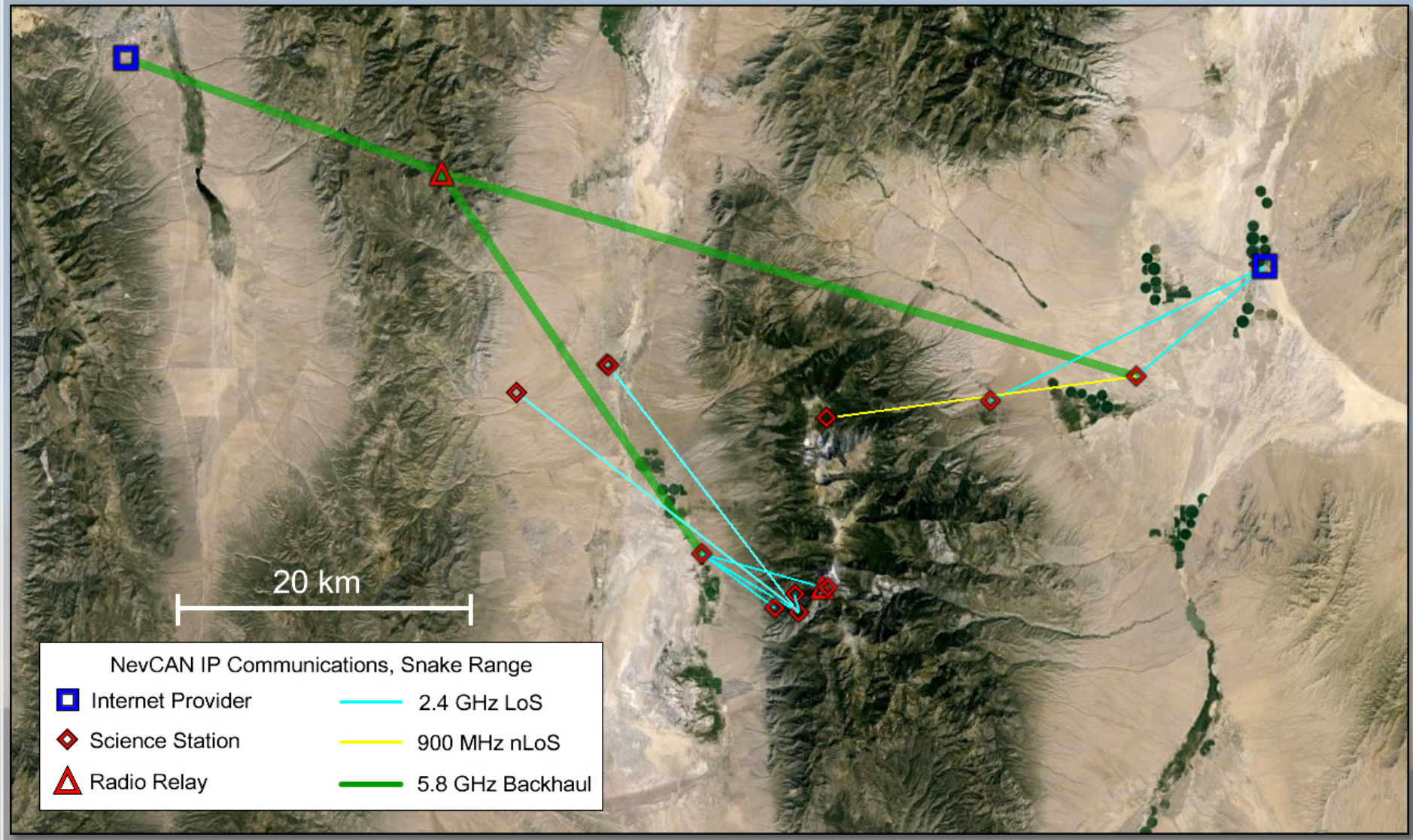
WRCC

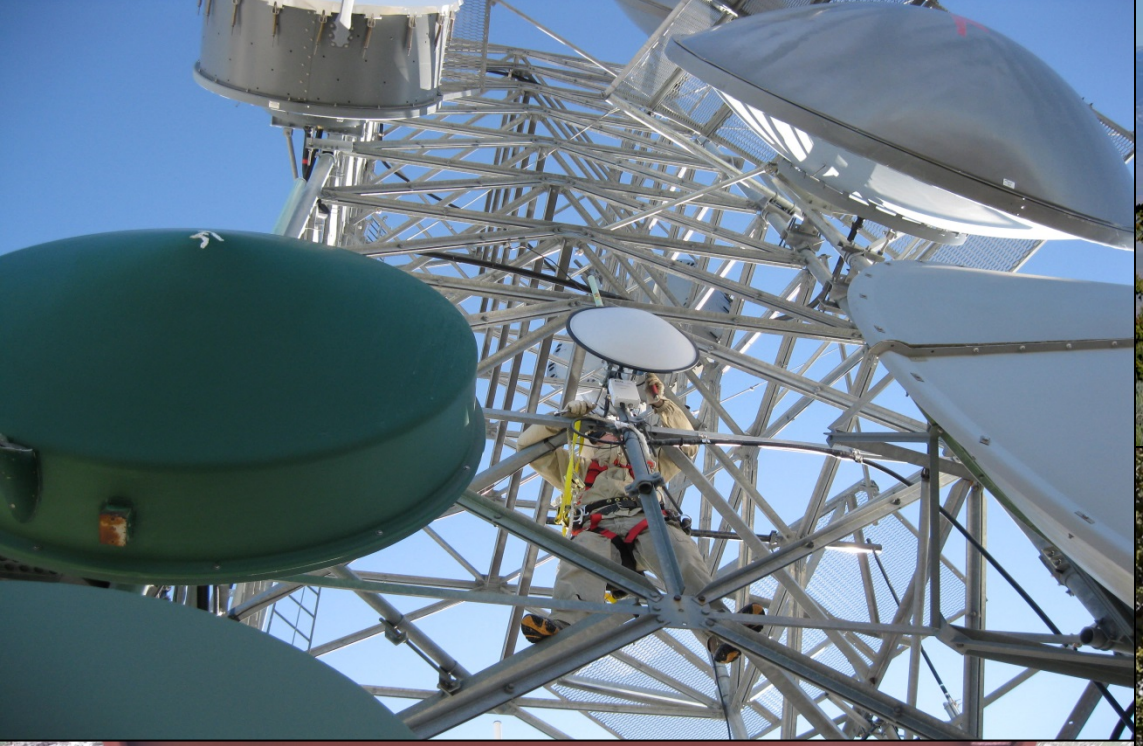
NV-EPSCoR Cyberinfrastructure

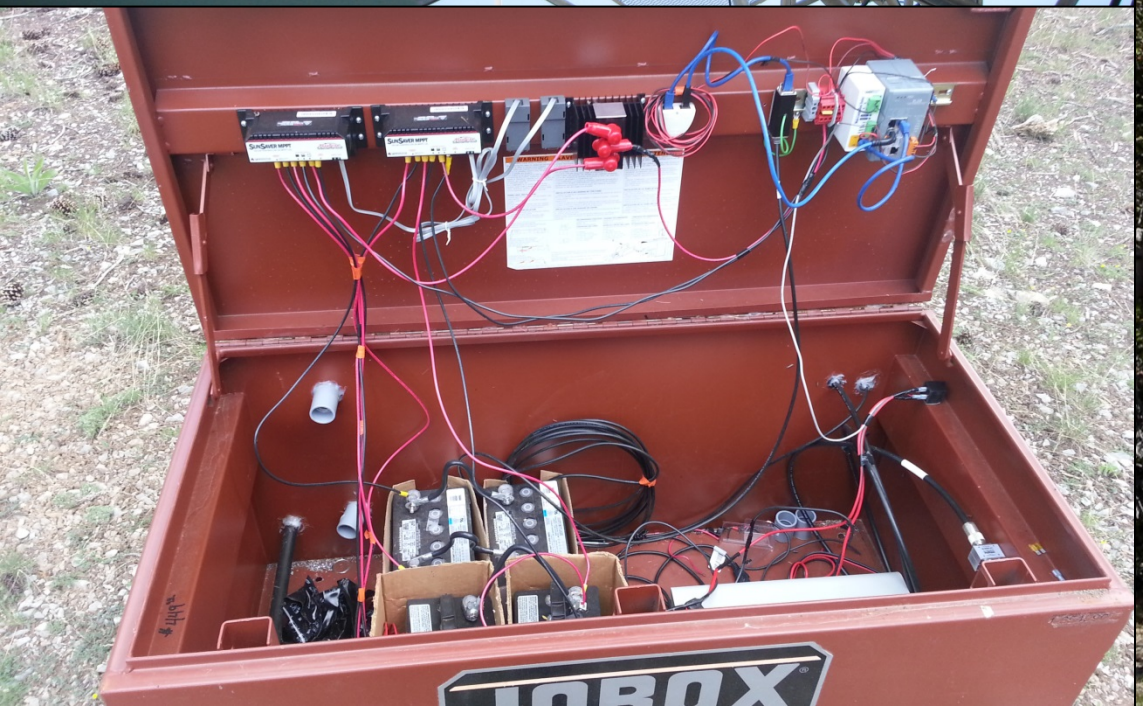
Hardware Control Software
Health & Status Monitoring
Hardware Metadata Tracking
Raw Data Archive
Database Import & Distribution



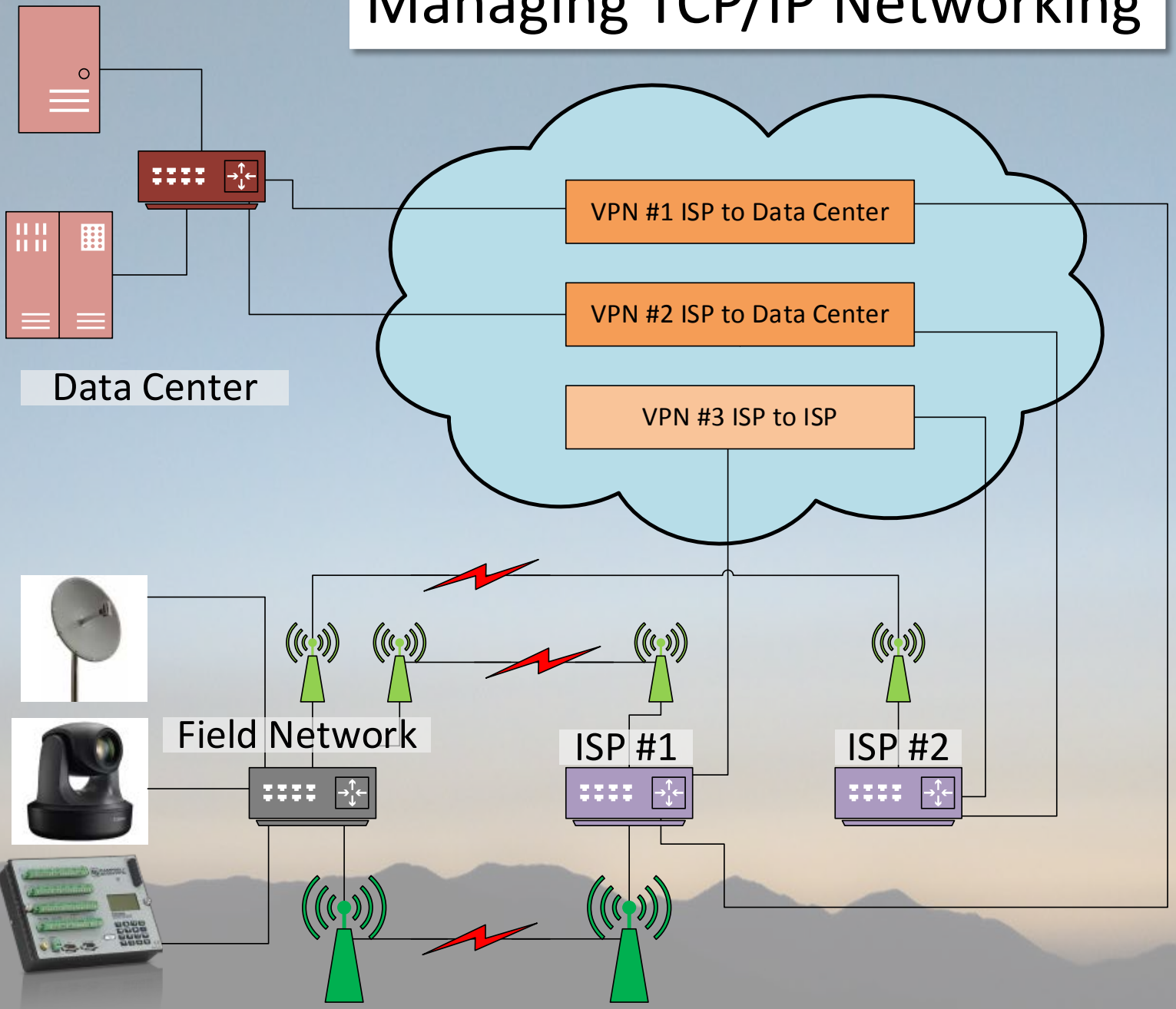
Field TCP/IP Networking



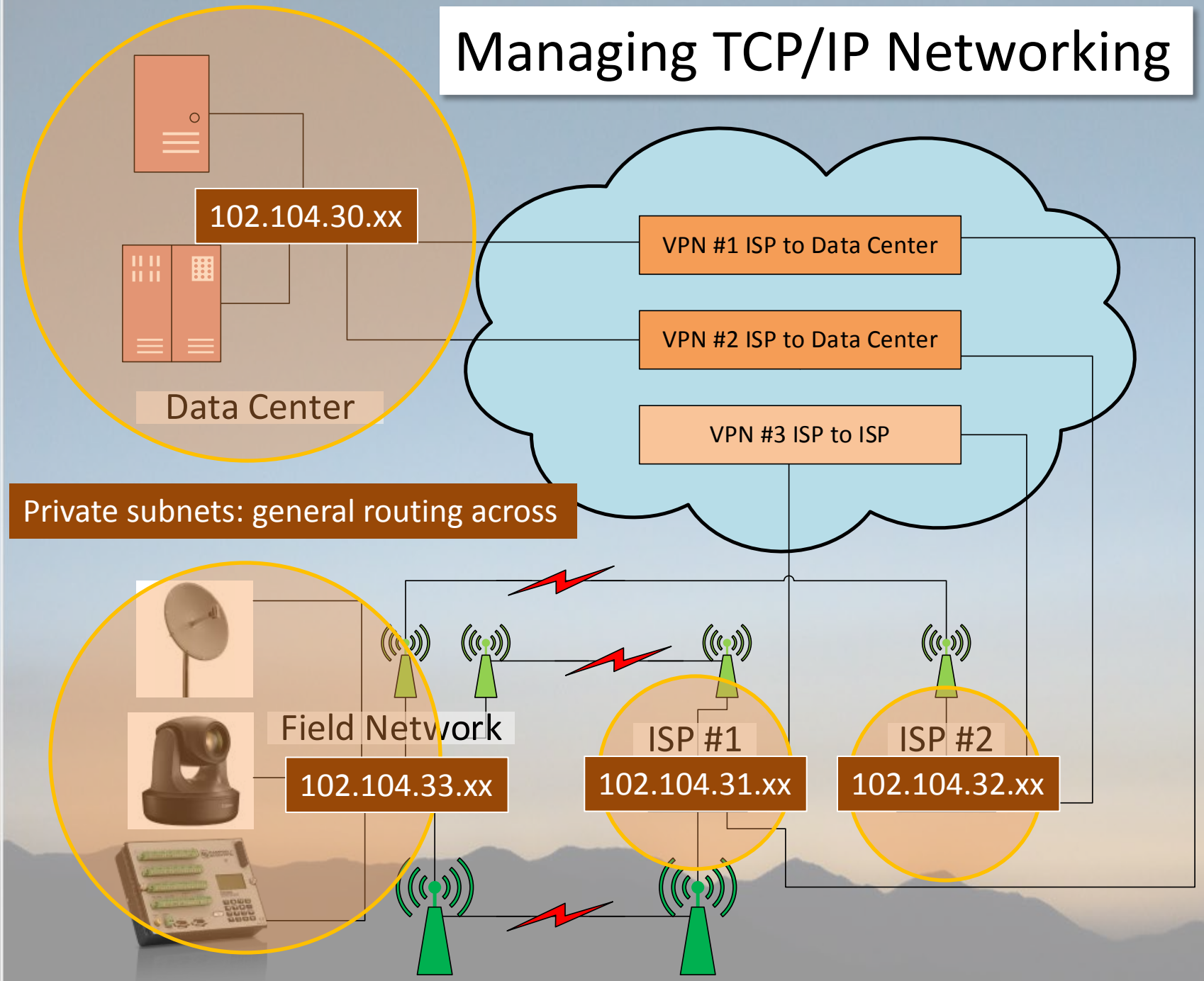



JOBOX

Managing TCP/IP Networking



Managing TCP/IP Networking



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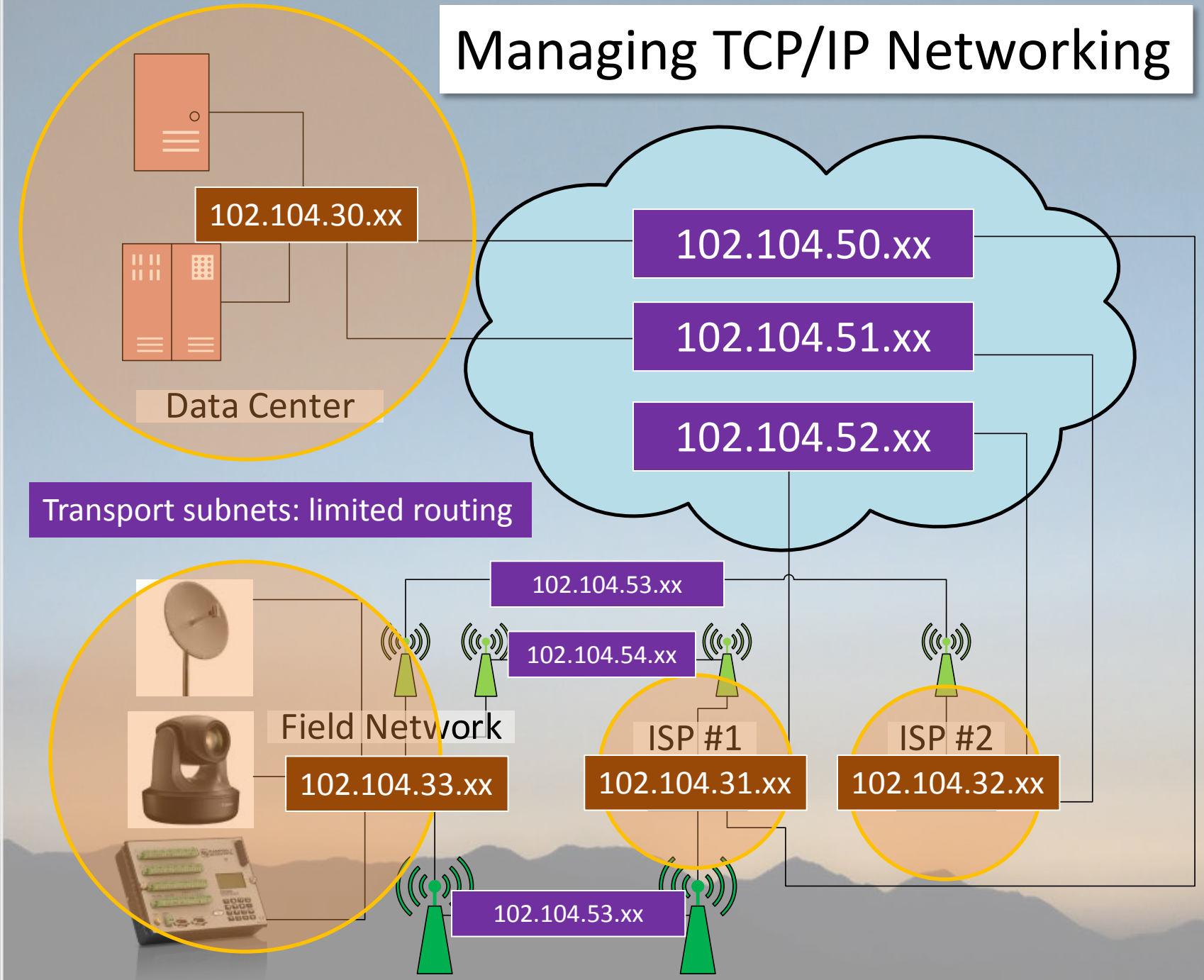
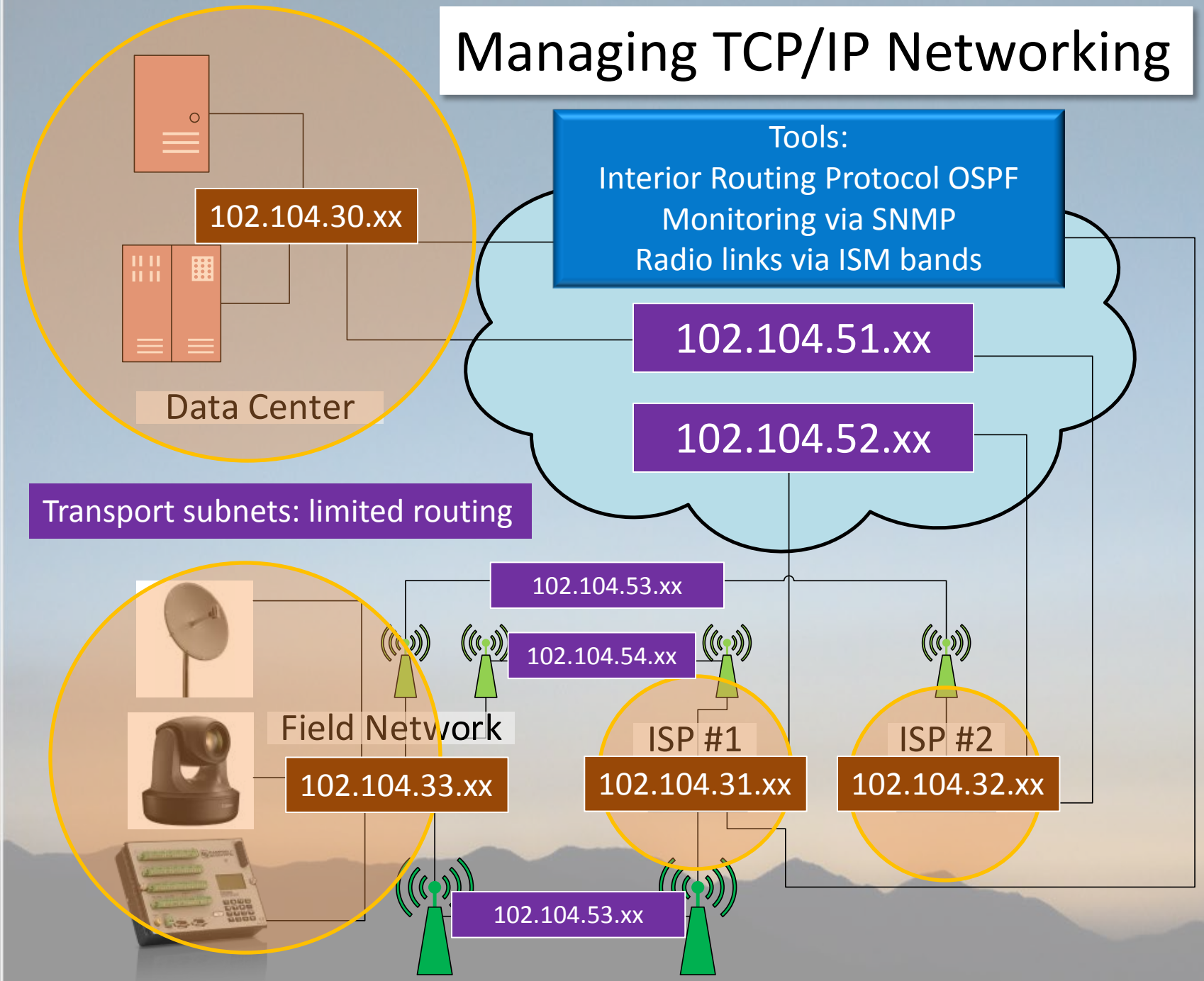
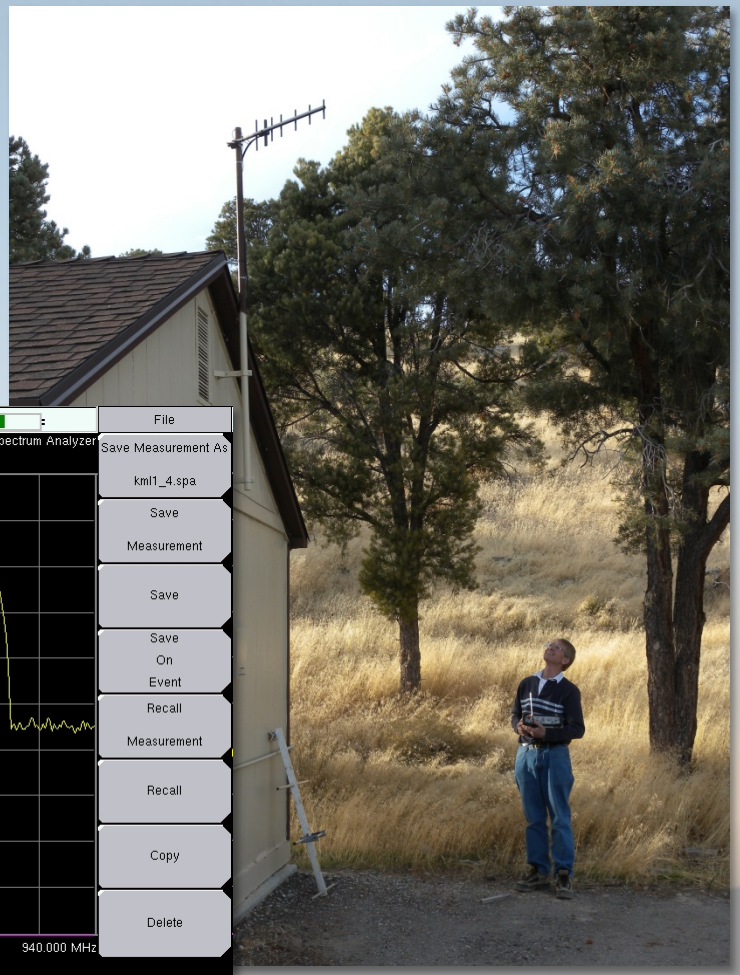


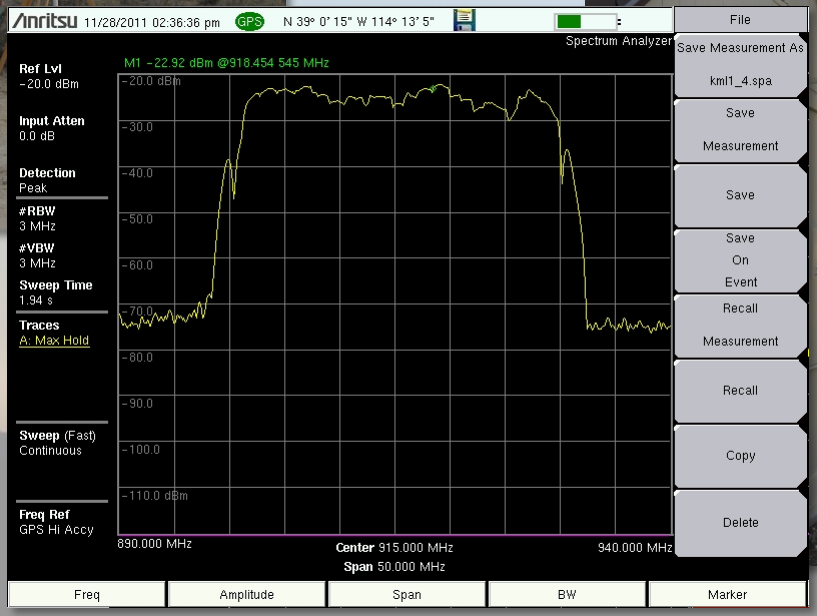
Managing TCP/IP Networking



Potential Problems

- *Radio interference*
- *Routing conflicts*





Acknowledgements

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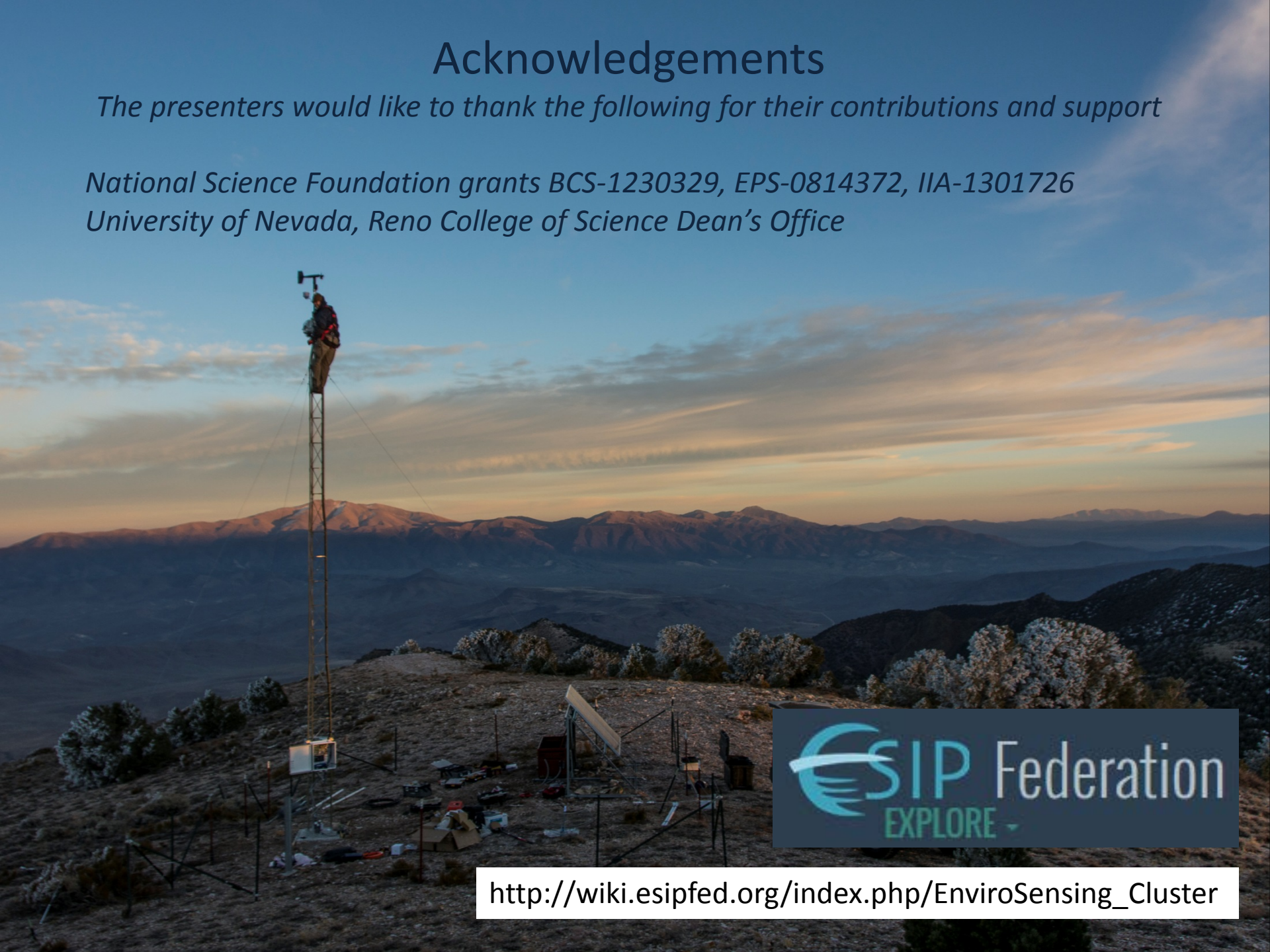

http://wiki.esipfed.org/index.php/EnviroSensing_Cluster